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THE EFFECT OF LUMEN TORTUOSITY AND GUIDE WIRE STIFFNESS ON MEASUREMENT OF VESSEL SIZE USING OPTICAL COHERENCE TOMOGRAPHY IN A CORONARY ARTERY MODEL

Poster Contributions
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Authors: *Edward Danson, Peter Hansen, Ravinay Bhindi, Royal North Shore Hospital, Sydney, Australia*

Background: Optical coherence tomography (OCT) is widely used for its role in sizing arteries for coronary intervention. A number of factors may be present in tortuous vessels which may impinge on the calculation of vessel size using OCT. An eccentric wire position is known to have an effect on the imaging of the lumen. Furthermore stiffer wires which may be required to deliver the OCT catheter in a tortuous artery may shortcut the course of the catheter along a tortuous vessel wall. We set out to determine the relationship between tortuosity, wire stiffness and OCT measurement of lumen length and diameter in a coronary artery model with varying lumen diameter.

Methods: Rubber tubing with lumen diameters of 1.7mm, 2.7mm, 3.2mm and 4.8mm were used to perform OCT images with a flexible (FW) and a stiff guide wire (SW) when straight or on a 25mm radius curve to simulate tortuosity. Lumen measurement points were marked in the wall of the tubing for detection on OCT and images acquired (n=10 for each wire and tube). Differences were determined in the OCT measurement of length and diameter at four crucial points on the curve.

Results: Lumen length was constant when straight but undersized between 0-4.5% (FW) and 0-12% (SW) when tortuous ($P<0.001$, FW vs. SW, unpaired t-test). Mean lumen diameter at fixed points was oversized by tortuosity (FW vs. SW for tube sizes 1.7mm: +0-0.1mm vs. +0.1-0.2mm, $P=0.31$; 2.7mm: +0.02-0.17mm vs. +0.18-0.46mm, $P<0.01$; 3.2mm: +0.35-0.39mm vs. +0.77-0.91mm, $P<0.001$; 4.8mm: +0.4-0.69mm vs. +0.88-1.05mm, $P<0.001$; unpaired t-tests).

Conclusion: This data suggests that OCT vessel undersizing of length and oversizing of diameter should be considered when performing coronary intervention in tortuous vessels. The effect is augmented by stiffer wires which may be required to deliver OCT catheters through tortuous coronary arteries.